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Assessing Use of Language as Mediating Mean in Science Teaching in Activity Theory Terms: A Discourse Analysis in Socioculturally Diverse Classroom Settings in Greece

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In this study, language is considered as mediating mean in science teaching within socioculturally diverse settings. It assesses how language can work in activity theory terms to understand scientific concepts. The particular interest concerns the nature of the Greek language which can give chances to approach more systematically scientific concepts. This research was conducted in two different classes of 5th grade pupils with socioculturally diverse characteristics in a Greek primary school through a discourse analysis tool that was used in other researches about science teaching. Language use took place in the context of activity theory, being a mediating mean. The results of the present study, lead to the conclusion that use of language in science teaching even in socioculturally diverse classroom settings can contribute to a better understanding of the scientific concepts, making scientific language familiar to pupils and facilitating them to appropriate it more effectively.

Keywords: language, science teaching, activity theory, discourse analysis, socioculturally diverse classroom settings.

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Оценка использования языка как средства опосредования при обучении естественным наукам с точки зрения теории деятельности: дискурсивный анализ в условиях социокультурного многообразия образовательной среды в Греции

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В этом исследовании язык рассматривается в качестве средства опосредования при обучении естественным наукам в условиях социокультурного многообразия образовательной среды. Оценивается, каким образом язык может способствовать пониманию научных концепций с точки зрения теории деятельности. Особый интерес вызывает специфика греческого языка, которая открывает возможности для более системного подхода к освоению научных понятий. Исследование было проведено на двух 5-х классах начальной греческой школы, отличающихся социокультурным многообразием, с применением методики дискурсивного анализа, использовавшейся также в других исследованиях, посвященных обучению естественным наукам. Язык использовался нами в соответствии с положениями теории деятельности, а именно — как средство опосредования. Результаты нашего исследования показывают, что использование языка при обучении естественным наукам в классе

даже в условиях социокультурного многообразия может способствовать лучшему пониманию научных понятий, делая научную терминологию более привычной для детей, а процесс овладения ею более эффективным.

Ключевые слова: язык, обучение естественным наукам, теория деятельности, дискурсивный анализ, социокультурное многообразие образовательной среды.

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Introduction

In modern societies, science education is a priority as modern societies require scientific and technological literacy for all citizens [16]. The request about "Science for all" regards science education as a fundamental right for everyone regardless of their background, nationality, language, and sociocultural conditions. It is suggested that scientific literacy is necessary for all people's personal, social, economic, and mental future. To correspond to society's requirements about science for all, there should be some decisive changes in school science as far as science education is concerned.

Special emphasis has been given to socioculturally diverse science teaching, since there is a great cultural divergence in science classrooms, either because of students' different ethnicity or because of their different sociocultural and economic backgrounds. In such a context, the culture of science and school science and students' culture is usually in dissent creating barriers for learning science [1; 4].

In these settings, language can play an important role. Sociocultural learning theories support that language mediates so that pupils could understand scientific concepts [26]. This implies that language can be a tool for pupils to cross the borders between scientific concepts and their experiences. Science terminology understanding is also culturally dependent. The term used to express a given scientific concept might imply something else in a non-scientific context. Thus, the meaning of these terms could vary from culture to culture [8].

In this study, students' group activities in socioculturally diverse science teaching are analyzed in the context of classroom discourse [5]. The activities are linguistically orientated in order to help students to appropriate the meaning of difficult science concepts.

The role of language in socioculturally diverse science teaching settings

It is argued that in modern science there are three types of language: science language, school science language, and students' language. Science as a discipline has its own language, its terms that sometimes differ a lot from the common language. Due to this fact, science seems to be alien to pupils. The significance of language use in a multilingual science class has been investigated in research conducted in South Africa using mixed research methods and found that a translanguaging-informed pedagogy can contribute to meaning-making in the science classroom [3].

The language of science and scientific communication plays a significant role in mythmaking; school science language plays an equally prominent role in creating barriers to universal access [8]. Hence, language usage is an important target for curriculum reform, especially in the context of multicultural and antiracist education.

School science language is often more complex than the language, pupils encounter in other areas of the curriculum, with longer sentences, more complex grammatical forms, and less familiar vocabulary [22]. Moreover, it is frequently depersonalized (through nominalization and the use of passive voice), emotionally detached, humourless, remote from real life, and uninviting.

Apart from the above two languages in science teaching, pupils have their own language which is influenced by their sociocultural background [17]. According to Bernstein, pupils talk either in the elaborated or the restricted code. In the former case pupils has almost no difficulty understanding the language of science but in the latter one pupil faces a lot of problems because of science language complexity [2].

Science language is depersonalized through excessive nominalization (replacement of active verbs by abstract nouns) and almost exclusive reliance on passive voice. For many pupils, all this constitutes such a formidable barrier that they are dissuaded from seeking entry to science. What is interesting here is why pupils react in such diverse ways to the experiences of school science, and why so many of those who shy away from science are members of ethnic minority groups [12; 21].

Pupils are said to have a 'linguistic deficiency' if they are not at home with the ponderous style of textbook science and teachers who feel obliged to imitate it in order to maintain standards. They also seem to assume that individual *words* are carriers of meaning as if a dictionary could really help pupils make sense of unfamiliar ways of using language [14]. This can be explained by a sociological perspective since, according to Bernstein, there are pupils — especially those who come from a lower economic or social background or they come from a foreign country — talk a restricted linguistic code that differs from that of school science, which is elaborated enough [2].

It has been suggested that scientific concepts can be analyzed and defined by means of comprehensiveness,

precision, consistency, and circularity. In such cases, a definition should be made comprehensive by including more features of definitions, but it can be overwhelming to have too many details in every feature. The definition should be reasonably precise and be internally consistent with respect to its common features [27].

In this context, the importance of language to constituting meaning in science learning has been recognized. Research on diversity and equity stimulates science educators to examine the nature of science and science education [13]. What counts as science or what should be taught in school science is critically important because this definition determines the school science curriculum. Western science, as traditionally practiced in the science community and taught in school science, is the "high-status knowledge" to which every student should have access in order to function competently in the mainstream, global economy, and information society.

In relevant research where discourse analysis was used to investigate science language demands in multilingual classrooms [20], there was also a focus on linguistic analysis in science activities but the pupils were from secondary education and studying in English.

To achieve equitable outcomes with diverse students, teachers need to have both knowledge of science and understanding of the students' languages and cultures. It is a challenge for teachers to integrate science and students' languages and cultures in ways that are meaningful and relevant to their students [13].

Activity theory in teaching science: utilizing language as a mediating tool

Recently, activity theory is presented as one of the most interesting views about learning and teaching. Vygotsky, on whom views activity theory has been based, described the dual nature of psychological tools [24]. On the one hand, they are externally-oriented, serving as the means through which humans affect material objects towards which activity is directed. However, they are also internally oriented in that they serve in the self-regulation of individuals as well as social negotiation of meaningful activity. In the educational context, teachers' knowledge serves similarly as both externally- and internally-oriented tools.

Activity theory as Engestr m has suggested it, allows us to examine the relations of participants (teacher-students) and the object as they are mediated by basic elements that constitute an activity system, that is to say, tools, community (school classroom), division of labour and rules [7].

The construction of this activity system, after careful analysis of the data, allowed us to consider the complexity of factors that influence how the activity of science outreach is practiced. First, note that the subject of the system is not an individual outreach scientist or even a panel of scientists. The subject is diverse, flexible, and consists of a community of people working towards a common object. The object is the "central issue" of the activity system. It brings meaning to the system because it connects the actions of individuals to collective activity [6]. The subject and object exist as a central dialectical unit, but the subject does not act directly on the object. Rather, the actions of the subject toward the object are mediated by a variety of factors, which form the rest of the system [17]. The subject and object cannot be made sense of outside the context of the (or a) system of these mediated factors.

Engeström has represented his views by forming a triangle as is presented below in Figure 1.

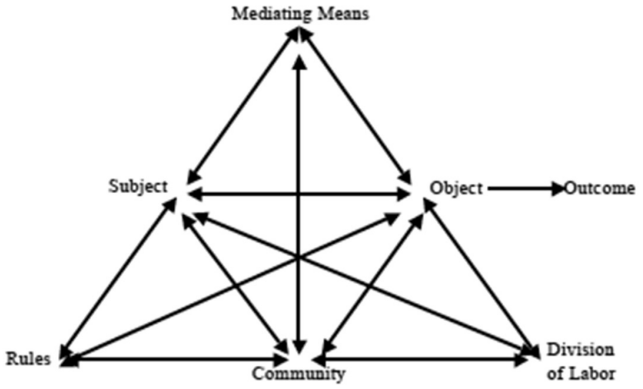

Fig. 1. Engestrom's Activity System Model [6]

Scientific concepts are concepts that cannot be learned spontaneously in engagement with everyday life [23]. According to Engeström's model, learning is a human activity, where tools such as language mediate the process between the subject (teacher, pupils) and object (science) which is turned into outcomes with the help of tools (e.g., language) leading to transform scientific concepts to familiar ones for pupils through activities with linguistic analysis [19]. In Science Education, language, which can be expressed in several modes of communication, is the main mediational instrument between the teacher, knowledge, and students [15]. So, in this study, activity theory is used as a model where pupils that work in groups, discuss the results of the group activity in the classroom approaching science teaching through linguistic analysis of scientific concepts in order to manage the meaning-making concerning these concepts.

Research Methodology

The main research question is to what extent language can contribute to achieving satisfying learning outcomes in science teaching and consequently how pupils negotiate meaning when they have to deal with scientific terms. To investigate this question, we videotaped and audiotaped the teacher-students' discourses during science lessons in socioculturally diverse science classrooms. Discourse analysis is selected because it has an analytic commitment to studying discourse as talk in social practices.

Discourse analysis is particularly used in cases that investigate what takes place in the school classroom [23]. Especially in science teaching Roth (2004) supports that discourse analysis can be used to clarify what happens in the school classroom during teaching highlighting the crucial role of language which is the main

subject in discourse analysis [18]. Finally, Lemke marks that the cultural dimension of discourses meaning can be understood in the context of activity [14].

Through discourse and joint action, two or more people build a body of common knowledge which becomes the contextual basis for further communication. Over messages, things actually said, are only a small part of the total communication.

Two classes were observed, in the first of which, there were 26 pupils (11 years old) of different sociocultural backgrounds (different nationality, gender, socioeconomic and educational status of the family, etc.), and in the second 18 pupils (11 years old) of different sociocultural background as well. Data collected included audio and videotapes of the lessons. In order to discuss the language role in multicultural science settings, we preferred a microanalysis of a selected episode. The tool of analysis was based on the work of Kaartinen and Kumpulainen (2001), who examined the meaning of negotiation in science communities of various levels [10]. The analysis focused on the dimension of discourse moves, which highlights the nature of conversational exchanges between the members of the learning and consequently sheds light on the participatory roles during a science lesson. The results are presented in Table 1.

According to Table 1, discourse moves identified in the analysis method are initiating, continuing, extending, explaining, questioning, repeating, agreeing/disagreeing, replying, tutoring, commenting, and concluding. Initiation moves are those that begin a new topic. Continuing moves are considered as reflecting pupils' interpretation of a situation while extending moves are thought to bring in new perspectives which expand joint explanation building. Explaining moves provide information and are usually based on reasoning. Questioning moves ask for information so as to form a joint understanding. Repeating moves repeat ideas that have already emerged during the discourse. Agreeing and disagreeing moves refer to the acceptance or rejection of proposals or explanations that have been presented previously during discussion. Replying moves refer to responses to explicit questions. Tutoring moves imply the guidance, support, and re-voice of the social activity in question. Commenting moves are statements uttered in course of discourse to give personal remarks or assessments of a situation. Finally, the concluding moves draw together the explanation of the building process.

According to the discourse analysis tool which is used in this study, there is a more specific investigation about the cultural focus of social interaction. The categories for this part of discourse analysis are activity mode, identity mode, material mode, and semiotic mode. Activity mode describes an interaction that focuses on procedural elements, such as negotiating working strategies for joint investigation. Identity mode presents the interaction that highlights the negotiation of personal and cultural meanings. Material mode concerns interaction that focuses on the physical features of the learning situation. Finally, semiotic mode describes an interaction that highlights the interaction in which the meaning-making is made visible through meditational tools.

The selection of this tool can be justified by the fact that the use of the language can contribute to the negotiation of meaning so as scientific concepts to be understood. By pointing to discourse moves as they are categorized by Kaartinen and Kumpulainen (2001), we are able to mark how smoothly pupils of socioculturally different backgrounds can cross the borders between science language, school science language, and pupils' language. To investigate the role of language in multicultural science settings, we present two dialogues that have taken place in socioculturally diverse classes.

Design of the learning environment

The learning environment is formed so that pupils are able to appropriate scientific knowledge. To achieve

Table 1

Discourse analysis method

Social interaction in communal activity	
Analytic Categories	**Definition**
Discourse moves	
Initiating	Begins new thematic or strategic interaction episodes
Continuing	Elaborates or furthers collective meaning-making
Extending	Brings in new perspectives
Explaining	Provides information often based on reasoning
Questioning	Requests' information in order to establish a joint understanding
Repeating	Repeats ideas or views that have emerged in the preceding interaction
Agreeing/disagreeing	Expresses acceptance or rejection of ideas or explanations
Replying	Responds to questions
Tutoring	Guides, supports or re-voices social learning activity
Commenting	Gives personal remarks or evaluations of the situation
Concluding	Draws together an explanation of building processes
Cultural focus	
Activity mode	Focuses on procedural elements, such as negotiating working strategies for a joint investigation
	Highlights the role negotiation between community members
Identity mode	Concentrates on physical features of the learning situation
Material mode	Highlights the visibility of meaning-making via mediational tools
Semiotic mode	

the best learning outcomes, we apply teaching strategies linguistically orientated in order to make science language familiar even for pupils that face linguistic problems due to their culture, either their foreign nationality or their family background (socio-economic status, their parents' educational level, etc.).

In an activity theory context, language is the meditating mean that can help pupils to negotiate the meaning of science as far as scientific concepts understanding. In a whole class (community) discussion, there are rules that promote social interaction between teachers and pupils who have to participate in specific linguistically orientated tasks (a division of labour).

We initiate the use of the dictionary, in order to achieve making scientific concepts familiar to pupils, an approach that has been suggested previously in the research [7]. Moreover, we attempt to make an initial linguistic analysis of these concepts concerning the root of words, their origins but also their connection with everyday life. This resulted in the linguistic interaction between pupil-teacher concepts meaning, which contributes to the pupils' best understanding of scientific concepts.

Engestrom's model in this study has the suggested form as it has been presented in other studies. Tools and artifacts have culturally produced the means like language that subjects use to perform the activity. Community refers to all the participants who share the same object, and shapes and direct individual actions to the collective activity. Division of labour refers to the way subjects have their specific roles taking the appropriate responsibilities in the context of the activity [11].

Data Analysis

The following dialogues concern teaching science in socioculturally diverse classroom settings and refer to two different classes of the 5th grade. The first one takes place in a class of 26 pupils, organized into groups of five or six members. Among these pupils are those from foreign countries, pupils with learning problems, and pupils of different cultures. The second one takes place in a class of 18 pupils, organized in groups of five or six members. Among these pupils, there are those from foreign countries, pupils with learning problems, and pupils of different cultures as well.

1. Transparent-translucent-opaque bodies

The observed class in the first case was organized in groups and the lesson referred to the unit: ***transparent-translucent-opaque bodies.*** In the Greek language, these three words have the same root. They can be seen as transparent, semi-transparent, no-transparent bodies. In order to make these words familiar to pupils, we took advantage of their roots, and using a dictionary, tried to bring pupils closer to these scientific terms. We use pupils' knowledge from the language lessons about how a word meaning changes if we add the prefixes semi and no.

The following dialogue (Table 2) implies a process of linguistic development in science teaching. Before pupils engage in an activity of classifying bodies in transparent-translucent-opaque[1], there is a discussion between the teacher and pupils to clarify these terms so they are understood.

Table 2

Discourse Analysis about Transparent, semi-transparent, no- transparent bodies

	Participant	Transcription	Social interaction		
			Discourse moves	Cultural focus	Thematic description
1	**Teacher**	....what is said in bold?	Questioning	Semiotic mode	Highlighting interactions in which there is an effort to investigate what pupils know
2	**Pupil 1**	Transparent, semi-transparent, no-transparent bodies	Replying		
3	**Teacher**	Do we understand what these words mean?	Questioning		
4	**Pupils**	Yes	Replying		
5	**Pupils**	No	Replying		
6	**Teacher**	Some of you said no. You have dictionaries on your desks. Do we know what *transparent* means?	Questioning	Material mode	Interaction that concentrates on the use of the dictionary
7	**Pupil 2**	It is a thing like gel that we can see from the other side as well.	Initiating	Semiotic mode	Highlighting interactions in which the meaning-making is based on definitions by the dictionary
8	**Teacher**	No transparent?	Questioning		
9	**Pupil 3**	It means the opposite that cannot be seen from the other side.	Replying, continuing		
10	**Teacher**	When in front of a word we put the prefix *non*	Initiating		
11	**Pupil 4**	It is the opposite	Explaining		

[1] In the Greek language there are particular prefixes that can utilize to understand scientific concepts. In this case, opaque body in Greek is expressed as no transparent body and translucent body is expressed as semitransparent. This makes it more convenient to understand the meaning of these concepts through linguistic analysis and the use of a dictionary which is a common activity in language lessons.

	Participant	Transcription	Social interaction		
			Discourse moves	Cultural focus	Thematic description
12	**Teacher**	It has the opposite meaning. I want groups to find what *transparent* and *semi-transparent* means	Tutoring	Activity mode	Interaction that focuses on activity based on dictionary
13	**Pupil 5**	I found the word *semi-transparent*	Continuing		
14	**Teacher**	Tell us what your dictionary says about *semi-transparent*	Initiating		
15	**Pupil 6**	Whatever is penetrated by light to an extent	Continuing		
16	**Teacher**	The dictionary says something very good	Commenting		
17	**Pupil 6**	Whatever is penetrated by light to an extent	Repeating		
18	**Teacher**	Whatever is penetrated by light to an extent, did you understand it?	Questioning	Semiotic mode	Interaction in which the meaning making is made visible by discussing linguistically the scientific terms
19	**Pupil 7**	Yes, when light penetrates a body less than a transparent one	Explaining		
20	**Teacher**	Yes, it is right, what else have you found? Tell us about *transparent*	Commenting, questioning, tutoring		
21	**Pupil 8**	What has transparency, the obvious	Replying		
22	**Teacher**	The obvious, the one who has transparency. Have you found the word *transparent*?	Repeating, questioning		
23	**Pupil 9**	The one who lets the light pass through it and allows us to see things that are behind	Replying		
24	**Teacher**	This definition is very good and it will help us do the activity. By this definition, we shall understand what *transparent* means. Repeat it.	Commenting, tutoring		
25	**Pupil 9**	The one who lets the light pass through it and allows us to see things that are behind	Repeating		
26	**Teacher**	We understand what *transparent* means. The transparent body lets light pass through it. *Semi-transparent* means what lets light pass but less.	Explaining		
27	**Pupil 4**	*Non-transparent*: the impenetrable by light, the suspect (it is a meaning of everyday use of this word)	Initiating, extending		
28	**Teacher**	Yes, we use this word in everyday life except physics. This word means someone that does something in secret, but we talk about science. Let's go to the activity.	Commenting		

As we can see from Table 2, there is a variety of discourse moves in this dialogue between teacher and pupils. The teacher not only questions or initiates but also comments on what is said. He tutors the pupils encouraging them to continue their effort and explaining when it is necessary. The teacher poses crucial questions for the clarification of these scientific terms (e.g., "Whatever is penetrated by light to an extent, did you understand it?"). He comments on some of the pupils' statements, such as "This definition is very good and it will help us to do the activity", and even when he repeats pupils' statements, he does so in order to use it as feedback to go on.

On the other hand, pupils, after investigating in their dictionaries, continue what the teacher says by reflecting on their interpretation according to what they have found in dictionaries about these terms. They extend what they find even beyond the field of science (e.g., "No-transparent: the impenetrable by light, the suspect", bringing in new perspectives, implying that the scientific concept may have a different meaning in everyday life. They are able to explain their understanding of concepts as Pupil 7 does when saying "Yes, when the light penetrates a body less than a transparent one". Particular emphasis should be given to Pupil 7, a girl from Albania who due to her nationality faces some linguistic problems. She actively participates in searching and this engagement with the dictionary helps her understand scientific concepts.

Concerning cultural focus, there is mainly a semiotic mode during the effort to make clear how to make the

meaning through linguistic analysis of scientific terms. Moreover, the material mode includes the use of the dictionary while the activity mode focuses on how the activity takes place.

Apart from that, during this linguistic-orientated action in science teaching, both the teacher and pupils seek for negotiating the meaning of scientific concepts. The dictionary plays a mediating role in pupils' effort to appropriate knowledge through the linguistic analysis of scientific words and the consequent dialogue during this action.

2. Self-luminous and hetero-luminous objects

The observed class in the second case was organized in groups and the lesson referred to the unit: the light sources. This episode has to do with the concepts of *self-luminous and hetero-luminous*. Both words have their second part in common (luminous). Their difference consists in their first part that changes their meaning. The pupils discuss with the teacher after having searched for the meaning of these words in dictionaries[2]. The results are provided in Table 3.

According to Table 3, in the second dialogue, there is a variety of discourse moves as well. The teacher questions and initiates but also comments on what is said explains and extends the meaning of scientific concepts, for instance, "Hetero in ancient Greek means the other", analyses linguistically the origins of these concepts, which can help pupils appropriate this scientific concept.

Moreover, pupils continue, reflecting on what the teacher says, reply to the teachers' questions or initiations and extend offering new perspectives in knowledge (e.g., "Self-luminous is an adjective"). By doing so, they manage to have a complete image of what scientific concepts under consideration mean, combining this knowledge with knowledge of another lesson, e.g., language lessons by recognizing that these words are adjectives. Especially, pupil 4 who is a boy coming from Albania not only participates in telling what he found but also replies to the question that the teacher makes to detect the level of understanding. The answer to the question "For example, is the sun self-luminous or hetero-luminous?" shows that this boy has understood what self-luminous is.

The above dialogue shows that pupils can construct their own understanding about certain scientific concepts, when they have various linguistic stimulants or when they take action to investigate the interpretation of such concepts.

Both dialogues point to the fact that pupils who are engaged in a linguistic task and particularly use the dictionary, become more familiar with scientific concepts that seem to be alien. The use of the dictionary in connection with the linguistic analysis of these words contributes to the effective negotiation of concepts' meaning.

Discussion

The use of language in science teaching which is the topic of this study, has been investigated by other studies. In Wong et al. study, there is a systematic framework to analyze scientific concepts by using definitions [27]. In our study, the scientific concepts are approached linguistically, by analyzing scientific concepts in their parts to understand the meaning of the concept, taking advantage of special features of the Greek language. Furthermore, the use of vocabulary has been suggested in other

Table 3

Discourse Analysis about Self-luminous and hetero-luminous objects

	Participant	Transcription	Social interaction		
			Discourse moves	Cultural focus	Thematic description
1	**Teacher**	Let this group tell us what *self-luminous* is.	Questioning	Activity mode	There is a discussion in the context of the activity.
2	**Pupil 1**	*Self-luminous*, what lights by itself	Replying		
3	**Teacher**	The one that has its own light, you found so, because if we say it lights, this implies that there is a human intervention. Tell again.	Continuing, commenting		
4	**Pupil 2**	Mister, we have written in a different way. *Self-luminous* is adjective, has its own light.	Extending		
5	**Pupil 3**	The one that produces the light on its own.	Continuing		
6	**Teacher**	This is *self-luminous*, and the group has found the word *hetero-luminous*. Tell us.	Initiating		
7	**Pupil 4**	*Hetero-luminous* is what takes the light from another.	Replying		
8	**Teacher**	*Hetero-luminous*. Tell us loudly.	Initiating		
9	**Pupil 4**	What takes the light from another.	Continuing		
10	**Teacher**	*Hetero* in ancient Greek means *the other*, so what is *self-luminous* and what is *hetero-luminous*? For example, the sun is self-luminous or hetero-luminous?	Explaining, tutoring	Semiotic mode	Linguistic analysis of scientific concepts.
11	**Pupil 4**	Self-luminous	Replying		

[2] In this case there is the utilization of composite words using dictionaries. In this special example, ancient Greek adjective "hetero" was utilized.

studies marking that there should be a more systematic approach to this tool [20]. In our study, vocabulary works as a tool, and a linguistic analysis follows leading to pupils' familiarization with the scientific concepts to make meaning in science teaching.

Moreover, in terms of cultural diversity, Charamba tries to understand the role of language in science teaching by using interview responses and pre- and post-test scores and manages to show that monolingual-oriented pedagogies in the Physics classroom hinder multilingual students' full understanding of scientific concepts leading to academic underachievement [3]. On the other hand, our study approaches the role of language in culturally diverse settings through a discourse analysis in the context of the activity theory model showing that concepts should be familiar to students in order to be understood.

Finally, concerning the activity theory context in science teaching, it has been suggested that science communication is one of the means that the science teacher can use to foster teaching activities leading to a model that aims to understand the teacher's movements for using science communication in the classroom [15]. In our study, the activity theory is used as a methodological approach in forming science teaching activities.

Conclusions

In the context of multicultural science settings, the meaning-making processes of scientific concepts imply that pupils who are active and engaged in a linguistic-orientated task that attempts to make it easier for them to negotiate these concepts, can be led to a deeper understanding. Language plays a mediating role within a sociocultural approach and facilitates pupils' appropriation of knowledge, taking advantage of features that language has (in this study, the features that the Greek language has, but something similar may take place in other languages as well). Both the presentation of the episodes and the discussion concerning the relation of this study with other relevant ones lead to the following conclusions:

- The use of language (e.g dictionary use) can contribute to the clarification of some difficult scientific concepts, making a distinction between the scientific use of language and everyday use of language, without rejecting the latter. Furthermore, scientific concepts become more familiar for pupils, especially those who face linguistic difficulties due to their culture (e.g., nationality, family culture).
- The dialogue between the teacher and pupils can lead to an explanation of concepts since the negotiation of their meaning creates suitable conditions for a socio-culturally constructed activity and successful performance in science teaching through different discourse moves and forms of cultural focus.
- Through language, there can be a crossing between science and students' worldview borders that are usually in contrast (science vs students' worldview). The smoother crossings that are succeeded through linguistic approaches in science teaching can help pupils' better understanding of scientific concepts.

To sum up, pupils' increased use of certain ways of using the language leads to better learning and conceptual understanding of science. Moreover, we have provided empirical support for the conception of science education as induction into a community of discourse or practice. Full participation in practice requires that one is oriented towards certain aspects of experience, that one frames one's activity in particular and that one interacts with the physical and social environment in appropriate ways. Pupils reach understanding through a gradual linguistic process, starting with dictionary use and continuing with linguistic analysis, leading pupils to the meaning-making as can be seen in both episodes.

As far as perspectives for further research, this study can trigger a multiple utilization of language in a science activity, which might be approached by various methodologies, not only discourse analysis. It could be extended to written language as well in the context of content analysis or include more artifacts such as ICT (e.g., using electronic vocabulary or other relevant Internet resources). The suggested ideas concern mainly qualitative research, in the context of the activity theory, considering language as a meditational tool.

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